

L E A R N

L A P A R O S C O P Y

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**EQUIPMENTS
AND
INSTRUMENTS**



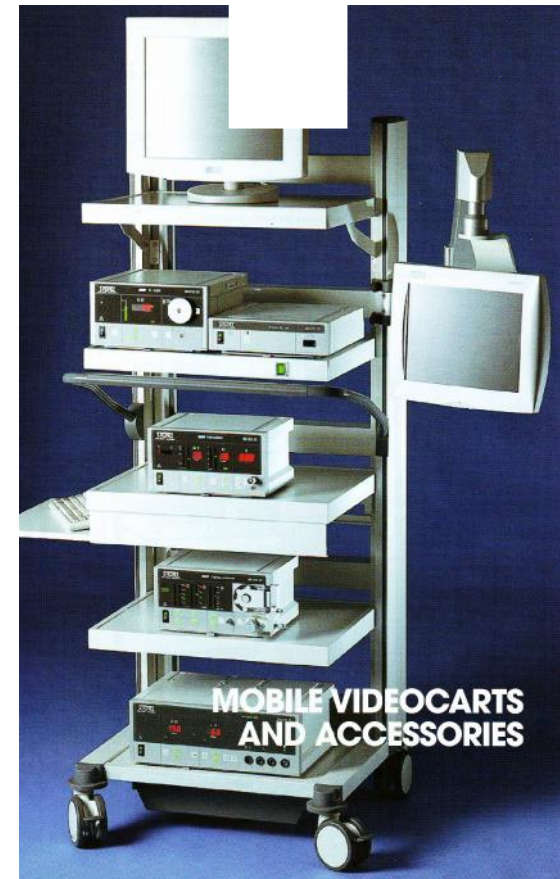
Equipments

In the Operative room (OR), we need the following equipments;

- \. Ordinary operative room equipments; as any laparoscopic operations may be changes to open surgery. So we need every thing which is necessary for open surgery like, ceiling lights, sucker, cautery (coagulation) machine, ...etc
- laparoscopic equipments, in a trolley ,
composing of ;
 - *Monitor and Video System
 - *Camera receiver
 - *Light Source
 - * Coagulation, cutting machine.
 - * CO₂ insufflators
 - * Suction, Irrigation unit

Video system

Camera



Laparoscopic trolley

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Camera receiver

A sophisticated apparatus which changes two colored pictures to multicolored or colored near normal pictures, put in the trolley, on which the camera will be connected

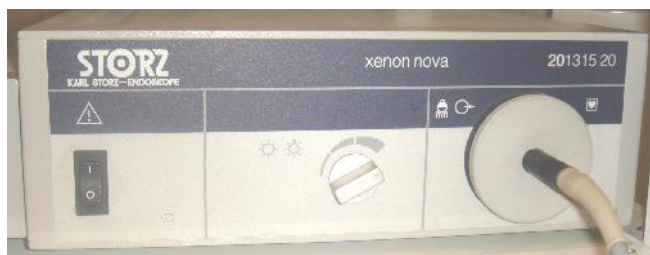


Camera receives the images from the telescope and displays it via the video system on both monitors. It attaches over the laparoscope eyepiece and in some cases it is an integral part of the scope. Cameras vary in sensitivity and image identification according to the number of silicon chips; a single chip camera has a resolution of 40 lines per inch



Light source

A high intensity cold light source such as xenon or a halide is required to provide sufficient light, which gives near normal colors and abolishes the shadow of the instruments

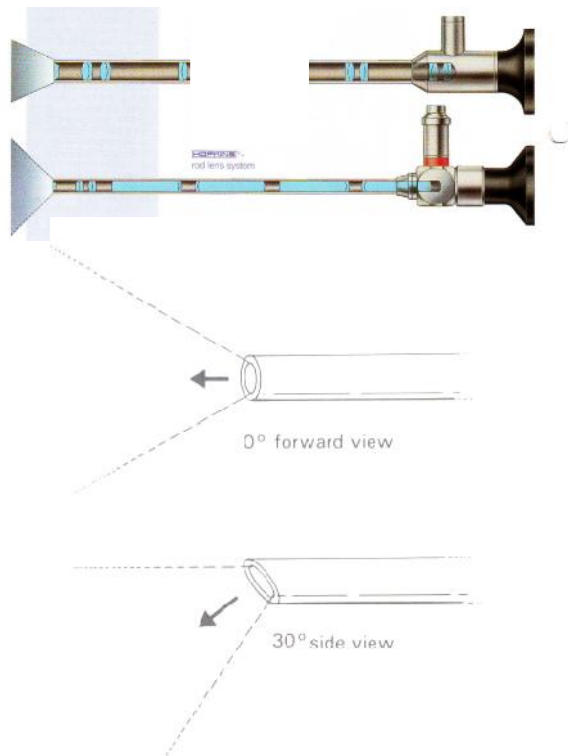


While a three chip resolves images to 400 lines per inch.



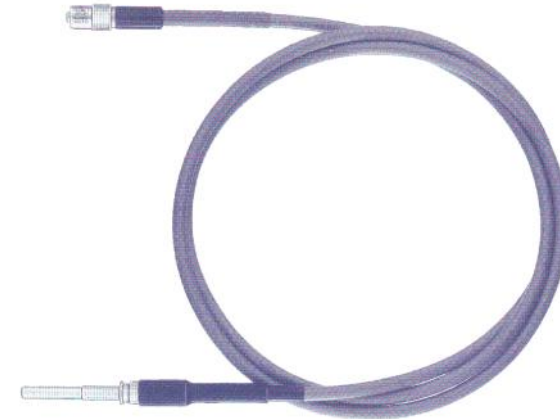
Telescope

It is a slender multi rigid lens system, either 6 or 10mm in diameter and 30 cm in length with different angle. Usually we use either 0° or 30° angle scope.



Light cable

A sheath containing hundreds of fiber optics to transmit the light from the light source to the telescope



Monitors

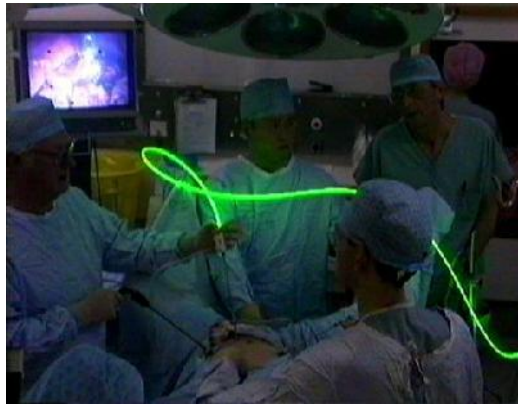
front of the surgeon, in order to save time and unnecessary effort, turning of the surgeon or the assistant.

A light resolution monitor should be compatible with the camera, for single chip camera a standard 4:3 line per inch monitor is adequate. The larger the monitor, the clearer the image



We need two monitors first in front of the camera man and or assistant and second in





Ultrasonic coagulation, cutting machine called Harmonic



Coagulating instruments

This party may be of many type, chronologically they are;

Electric coagulation, cutting machine



Laser coagulation, cutting machine

Ligasure coagulation, cutting machine which is just electric coagulation, cutting machine, with special range of strength and special hand instruments which is thermo- regulating negatively feed backing the machine to stop in certain temperature



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Controlled pressure insufflation of the peritoneal cavity is used to achieve the necessary work space for laparoscopic surgery by distending the antero-lateral abdominal wall and depressing the hollow organs and soft tissues. Carbon dioxide is the preferred gas because it does not support combustion, it is very soluble which reduces the risk of gas embolism, and is cheap.

Automatic insufflators allow the surgeon to preset the insufflating pressure, and the device supplies gas until the required intra-abdominal pressure is reached. The insufflator activates and delivers gas automatically when the intra-abdominal pressure falls because of gas escape or leakage from the ports.

The required values for pressure and flow can be set exactly using jog keys and digital displays. Insufflation pressure can be continuously varied from 0 to 30 mm Hg; total gas flow volumes can be set to any value in the range 0-9.9. Patient safety is ensured by optical and acoustic alarms as well as several mutually independent safety circuits. The detail function and quadro-manometric indicators of insufflator is important to understand safety point of view. The important indicators of insufflators are preset pressure, actual pressure, flow rate and total gas used.

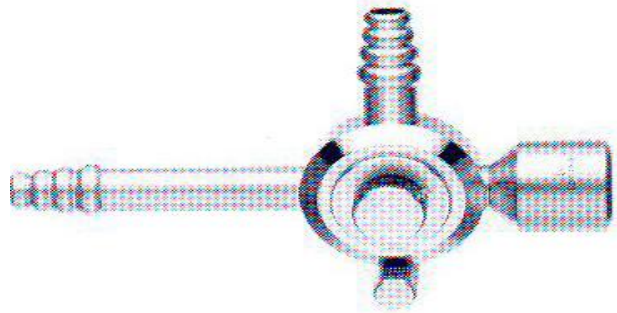
CO₂ insufflators

The Electronic CO₂ Laparotiator is a general purpose insufflation unit for use in laparoscopic examinations and operations.



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This is a unite which enable the surgeon to use both irrigation and suction via same hand instrument



Suction, irrigation unit

It is used for flushing the abdominal cavity and cleaning during endoscopic operations. It has been designed for use with the 26173 AR suction / instillation tube. Its electrically driven pressure/ suction pump is protected against entry of bodily secretions. The suction irrigation machine is used frequently at the time of laparoscopy to make the field of vision clear. Most of the surgeons use normal saline or ringer lactate for irrigation purposes. Sometime heparinized saline is used to dissolve blood clot to facilitate proper suction in case of excessive intra-abdominal bleeding.



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In developing countries, disposable instruments are very rarely used because labour cost is low compare to the cost of disposable instrument. In Europe and USA, surgeons often choose to use disposable instrument in order to save high labour cost. The main advantage of disposable instrument is high performance due to its sharpness and reduced chance of disease transmission due to certified high-end factory sterilization. However, once discarded, environment concerns are raised about disposal and biodegradability of disposable instruments. Ideally disposable instrument should not be used repeatedly because handling, sorting, storing and sterilization make these instrument questionable. The disposable instruments are not sterilized properly by dipping in gluteraldehyde because they are not dismountable. Insulation of disposable instrument also can be torn easily which can lead to electrosurgical injuries.

Veress Needle

Veress needle was invented by a chest physician for aspiration of pleural effusion keeping in mind that its spring mechanism and blunt tip will prevent the injury of lung tissue. Veress needle consists of an outer cannula with a beveled needle point for cutting through tissues. Inside the cannula is an inner stylet, which is loaded with a spring that spring forward in response to the sudden decrease in pressure encountered upon crossing the abdominal wall and entering the peritoneal cavity. The lateral hole on this

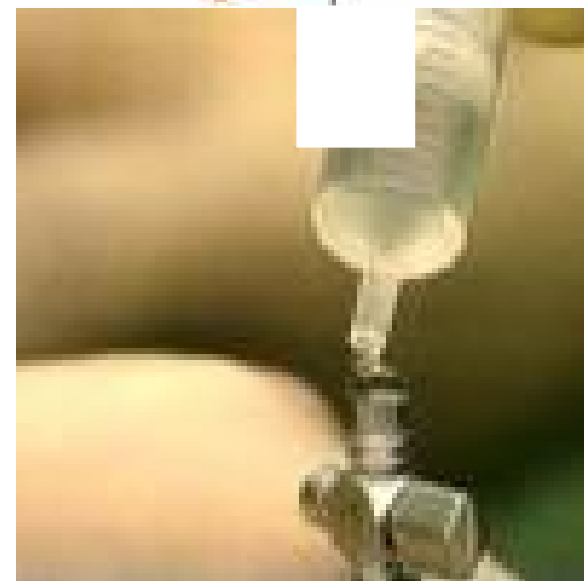
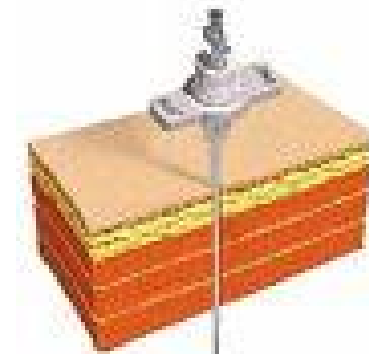
INSTRUMENTS

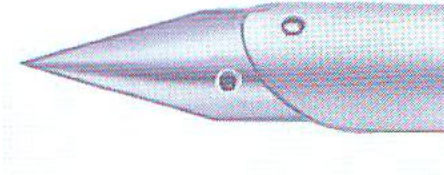
Several factors should be considered at the time of choosing laparoscopic instrument, including cost, availability and reliability. Reusable instruments are expensive initially but in long run they are cost effective. The disposable instrument cost is less compared to re-usable but patient cost is increased. In many countries re-use of disposable instrument is seen.

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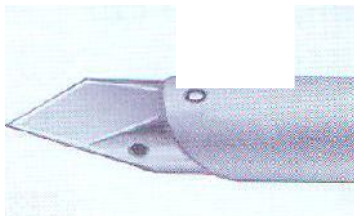
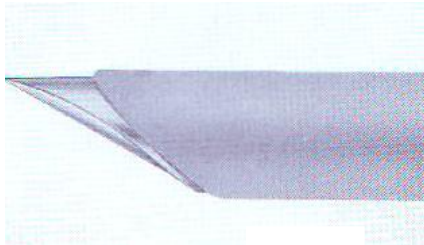
Veress needle is used for creating initial pneumoperitoneum so that the trocar can enter safely and the distance of abdominal wall from the abdominal viscera should increase. Veress needle technique is the most widely practiced way of access. Before using veress needle every time it should be checked for its potency and spring action. Veress needle is available in three length 80mm, 100mm, 120mm. In obese patient 120mm and in very thin patient with scaphoid abdomen 80mm veress needle should be used. Veress needle should be held like a dart at the time of insertion..

stylet enables CO₂ gas to be delivered intra-abdominally.





Conical tipped trocars are supposed to be less traumatic to the tissue.



TROCAR and CANNULA

The word “trocar” is usually used to refer to the entire assembly but actual trocar is a stylet which is introduced through the cannula. The trocars are available with different type of tips. The cutting tips of these trocars are either in the shape of a three edged pyramid or a flat two edged blade.



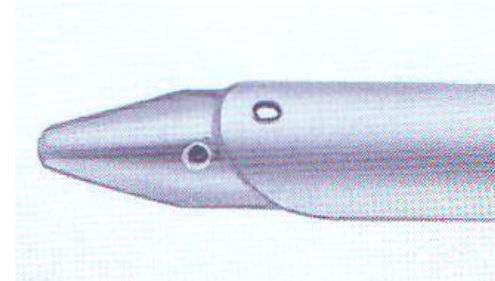
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Most of the disposable plastic trocar has a spring loaded mechanism that withdraws the sharp tip immediately after it passes through the abdominal wall to reduce the incidence of injury of viscera. Trocar and cannula are of different sizes and diameter depending upon the instrument for which it is used. The diameter of cannula ranges from 3 mm to 30 mm; the most common size is 5mm and 10 mm. The metal trocar has different type of tips i.e. pyramidal tip, Eccentric tip, conical tip or blunt tip depending on the surgeon's experience.

All the cannula has valve mechanism at the top. Valves of cannula provide internal air seals,



The tip can be penetrated through the parietal wall without cutting and decreased risk of herniation or haemorrhage is reported.



Cannulas are in general made from plastic or metal. Plastic devices whether they are transparent or opaque, need to be designed in such a way as to minimize the reflection of light from the telescope.

Reusable and disposable trocars are constructed by a combination of metal and plastic. The tip of disposable trocar has a two edged blade. These are very effective at penetrating the abdominal wall by cutting the tissue as they pass through.



Surgeon should remember that sharp trocars although looking dangerous are actually better than blunt one because they need less force to introduce inside the abdominal cavity and chances of inadvertent forceful entry of full length of trocar is less..

There is always a difference in the marked exterior diameter of the cannula and the interior usable diameter. The end of the cannula is either straight or oblique. An oblique tip is felt to facilitate the easy passage of the trocar through the abdominal wall.

Trocar and cannula should be held in proper way in hand so that head of the trocar should rest on the thenar eminence, the middle finger should rest over the gas inlet and index finger is pointed towards the sharp end of the trocar.

REDUCERS

Mot of the time the pot of the reusable clip applier, which is 10mm, used for introduction of other hand instruments like grasper, dissecting forceps, suction irrigation tip or for coagulation hand piece which are 5mm in girth. To prevent loss of insufflated CO₂

which allow instruments to move in and out within cannula without the loss of pneumoperitoneum. These valves can be oblique, transverse, or in piston configuration.

These valves can be manually or automatically retractable during instrument passage.



Trumpet type valves are also present which provide excellent seals, but they are not as practical as some of the other systems. They require both hands during instrument insertion, which may explain why they are less often used in advanced laparoscopic cases.

The flexible valves limit the carbon dioxide leaks during work whatever the diameter of the instrument used.



from 10mm cannula , we will be obliged to use reducer to seal the defect and allow 5mm instrument we could call the reducer 10mm to 5 mm adapters . There are two types of reducers, the old one is as long as the cannula needs to be put and on change to 10mm instruments like clip appliers to be removed which takes up to one minute of the time at each insertion.



While the new type of reducer is a piece attached to the base of the cannula, needs seconds to be put and removed each time.

Laparoscopic Hand Instruments

Laparoscopic hand instruments vary in diameter from 1.8 to 12mm but majority of instruments are designed to pass through 5 to 10mm of cannula. The hand instrument used in laparoscopic surgery are of different length (varies company to company and length of laparoscopic instrument varies from 18 to 45cm) but they are ergonomically convenient to work if they have the same length of approximately 36 cm in adult and 28 cm in pediatric practice. Shorter instruments 18 to 25cm are adapted for cervical and pediatric surgery. Certain procedures for adult can also be performed with shorter instrument where the space is constricted. 45cm instruments are used in obese or very tall patients. For better ergonomics half of the instruments should be inside the abdomen and half outside. If half of the instrument is in and half out, it behaves like class 1 lever and it stabilizes the port nicely so the surgery will be convenient.

Most of the laparoscopic procedures require a mixture of sharp and blunt dissection techniques, often using the same instrument in a number of different ways. Many laparoscopic instruments are available in both re-usable and disposable version. Most re-usable instruments are partially dismountable so that it can

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Different Handles of Hand instrument

Certain instruments handle are designed to allow locking of the jaw.



This can be very useful when the tissue needs to be grasped firmly for long period of time preventing the surgeons hand from getting fatigue. The locking mechanism is usually incorporated into the handle so that surgeon can easily lock or release the jaws. These systems usually have a ratchet so that the jaws can be closed in different position and to different pressure.

be cleaned and washes properly. Some manufacturer have produced modular system where part of the instrument can be changed to suit the surgeon favorite attachment like handle or working tip.

Most laparoscopic instruments like graspers and scissors has basic opening and closing function. Many instrument manufacturers during past few years are able to rotate at 360 degree angle which increases the degree of freedom of these instruments. Certain types of instrument offer angulations at their tip in addition to usual 4 degree of freedom. These instruments are used to avoid obstacles and for the lateral grasping when the instrument is placed outside of the visual field. This feature is available for both re-usable as well as disposable instrument. The complex mechanism of such instrument makes their sterilization very difficult.

A variety of instruments, especially retractors have been developed with multiple articulations along the shaft. When these are fixed with the tightened cable the instrument assumes a rigid shape which could not have been introduced through the cannula. Most of the hand instrument has three detachable parts.

1. Handle,
2. Insulated outer tube and
3. Insert which makes the tip of the instrument.

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Some multifunctional Laparoscopic handle has attachment for suction and irrigation and some time hand switch for cutting and coagulation switch of electrosurgery.

Cuschieri Ball Handle is invented by Prof. Sir Alfred Cuschieri. This handle lies comfortably in surgeon's palm.

This design reduces the fatigue of surgeon and eases rotation of the instrument by allowing rotation within the palm rather than using wrist rotation. Squeezing the front of the handle between the thumb and the first fingers increases the jaw

closing force; squeezing the rear of the handle between the thenar eminence of the thumb and last fingers opens the jaws.

Cuschieri pencil handle also has great ergonomic value specially when used with needle holder.

This handle allows the angle between the handle and the instrument to be altered to suit the surgeon's wrist angle. The conveniently placed lever of this pencil handle when pressed can change the angle. Just like ball handle, pressure at the front increases the jaw closing force while pressure at the rear opens the jaw.

Most of the Laparoscopic instruments handle has attachments for unipolar electrosurgical lead



and many have rotator mechanism to rotate the tip of the instrument.



Most of the instruments are composed of

Handle
Insert or the shaft
Tip

All are different in the tip, some in handle
So we try to show you the tip of the instrument in
each group to make easy for recognition

Outer Sheath of Hand Instrument

The insulation covering of outer sheath of hand instrument should be of good quality in hand instrument to prevent accidental electric burn to bowel or other viscera.

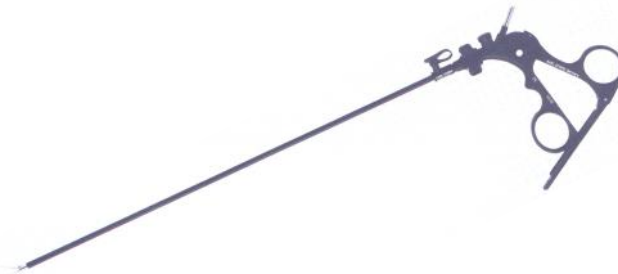
Insulation covering may be of silicon or plastic, at the time of cleaning the hand instrument, utmost care should be taken so that insulation should not be scratched with any sharp contact. A pin hole breach in insulation is not easily seen by naked eye but may be dangerous at the time of electro surgery.

Insert of Hand Instrument

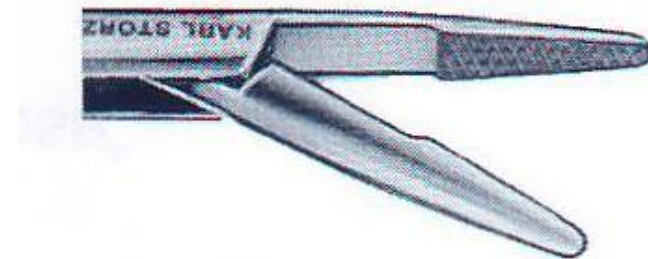
Insert of hand instrument varies only at tip. It may be grasper, scissors, or forceps. This grasper may have single action jaw or double action jaw. Single action jaw open less than double action jaw but close with greater force thus, most of the needle holders are single action jaw. The necessary wider opening in double action jaw is present in grasper and dissecting forceps. Single action graspers and dissectors are used where more force is required.

GRASPING DISSECTING FORCEPS

Used to grasp, hold, retract and rotate the intraabdominal viscera;

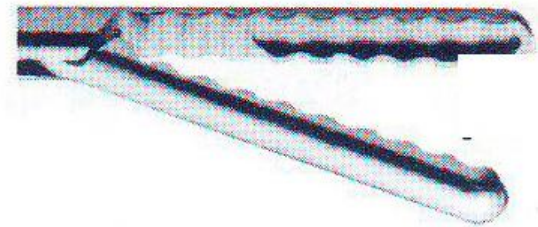
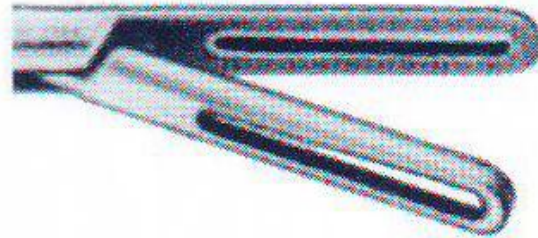
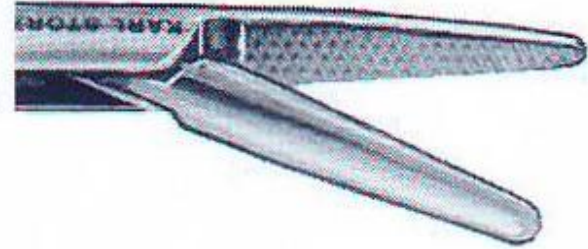
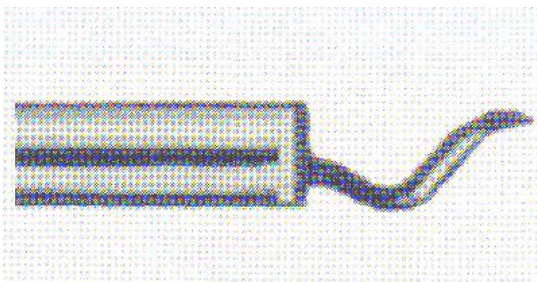
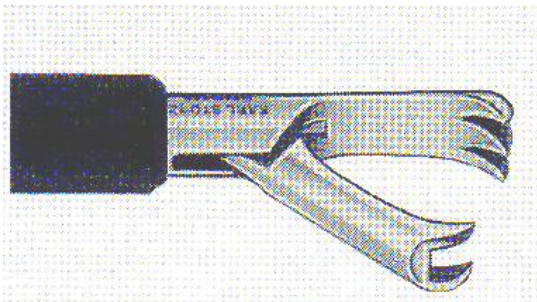
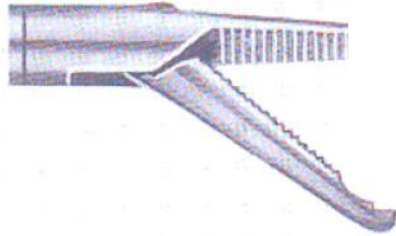
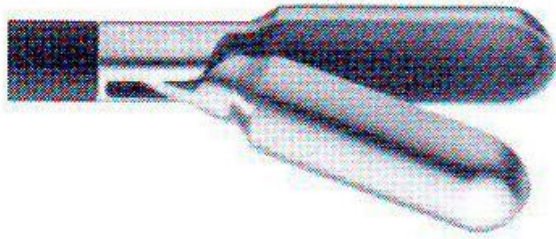


*single jaw

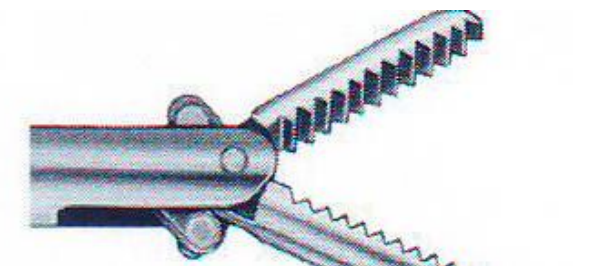
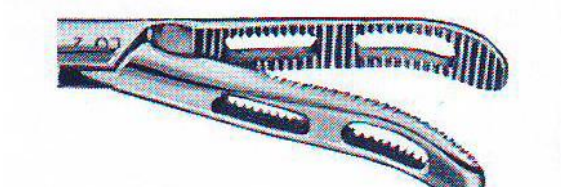
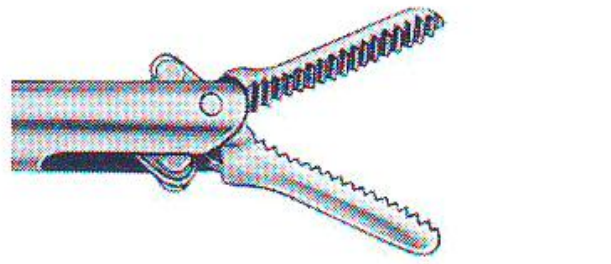
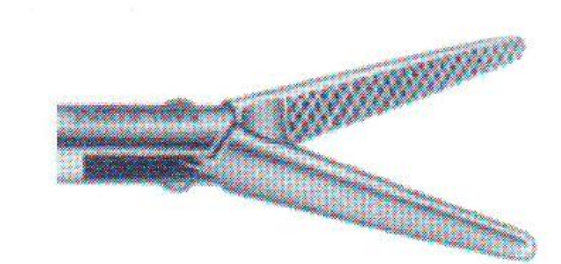
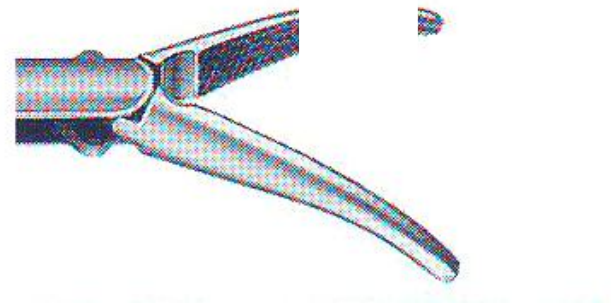
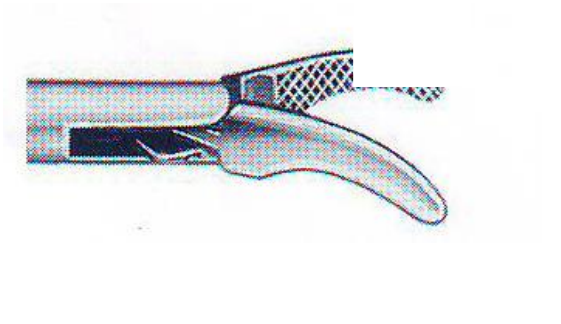


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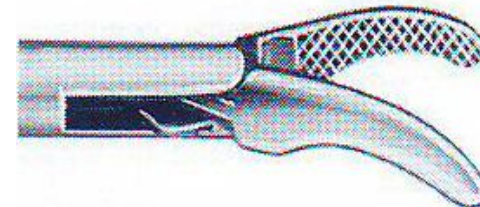
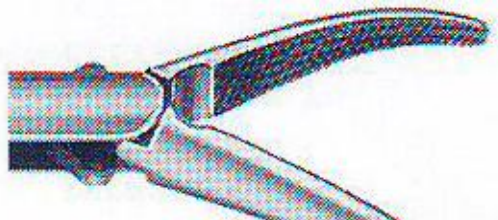
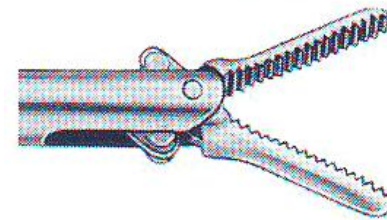
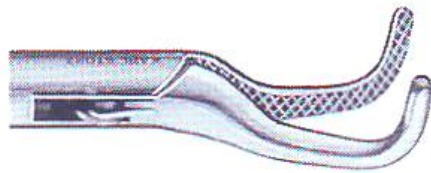
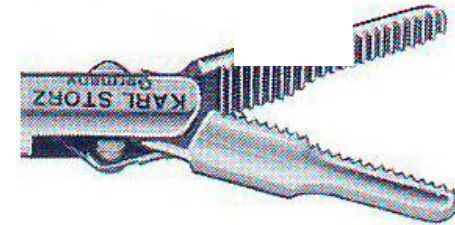


Gynecology grasper



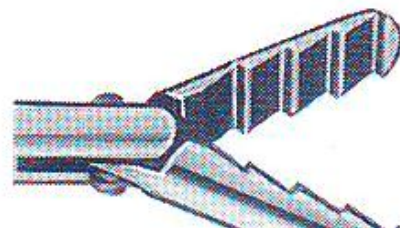
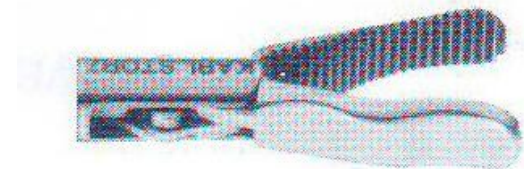
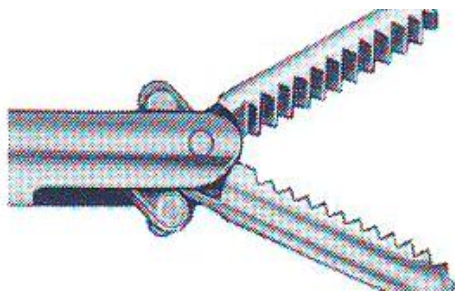
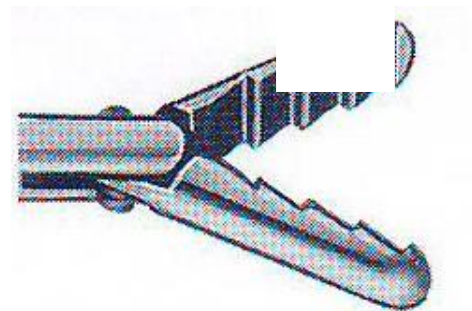
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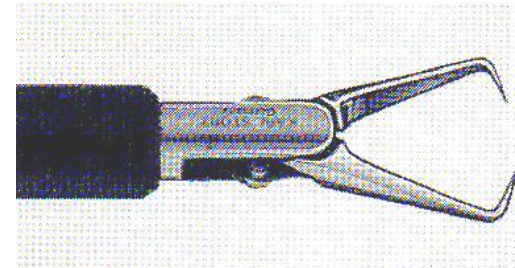
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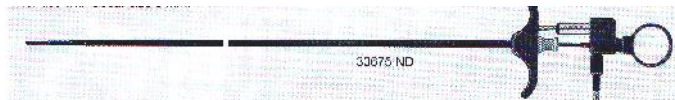


Dissecting Biopsy forceps

**It also composed of three parts the handle either
ordinary**

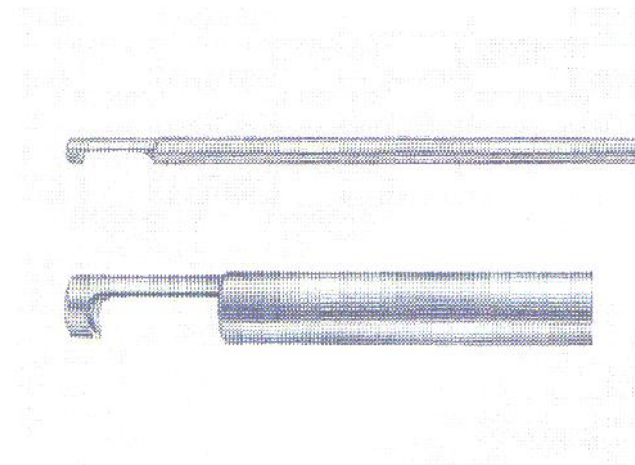
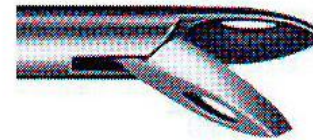


Spring-loaded handle



**The shaft is same in all types, while the tips are
different**

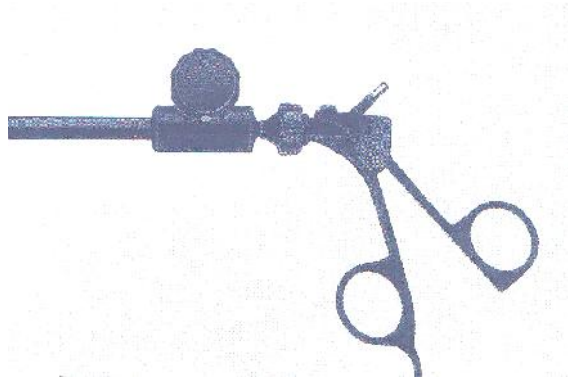
Sponge holder



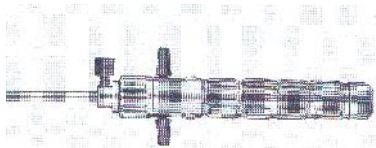
Scissors

It also has three parts;

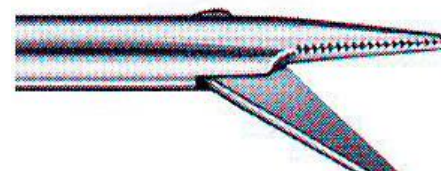
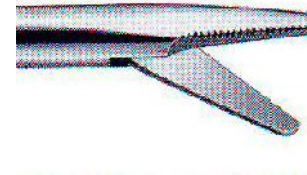
Handle may be ordinary

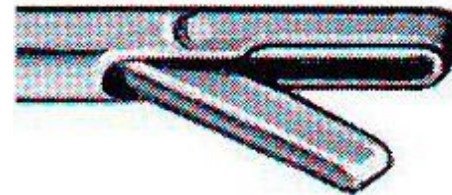
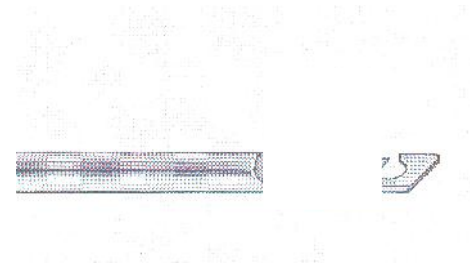


Or it may be slender



While the tip is of different type and sizes



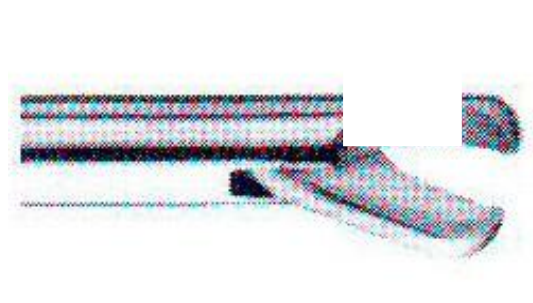


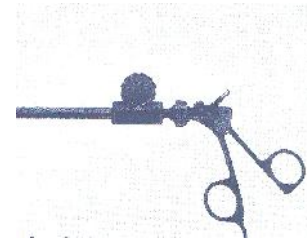
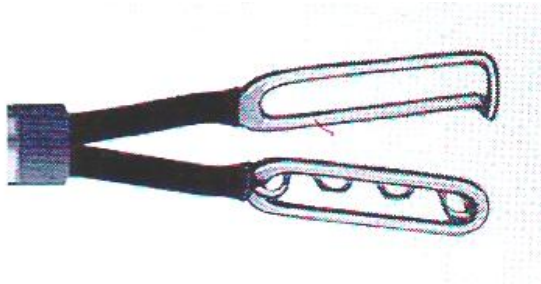
Coagulating instruments

Also it consists of three part handle which is either slender

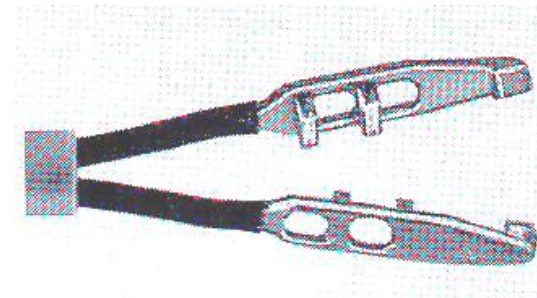
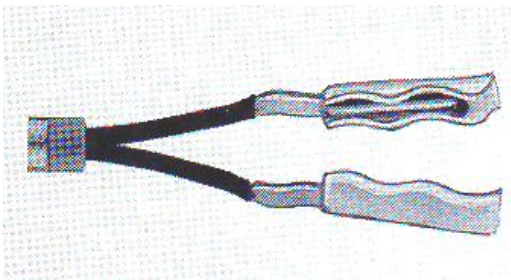
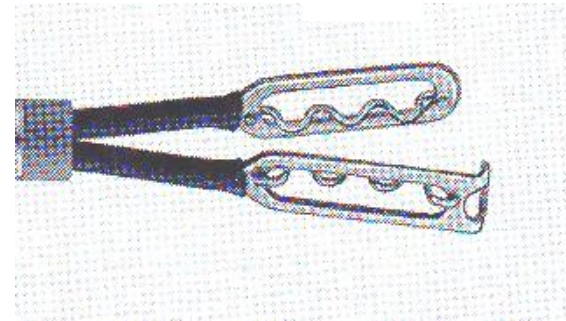
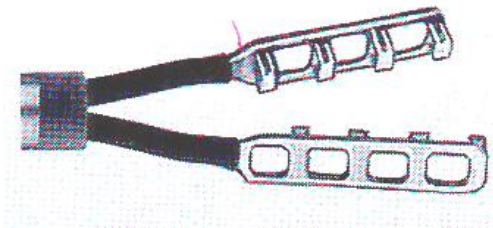


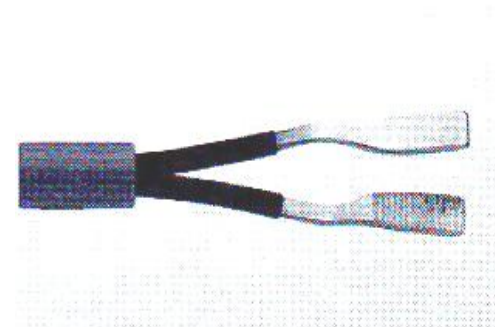
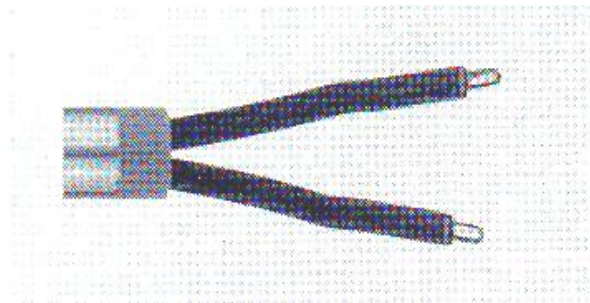
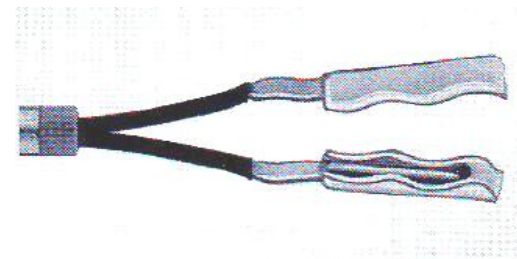
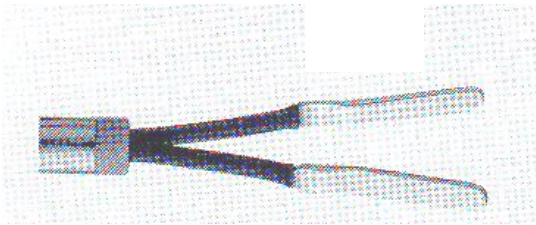
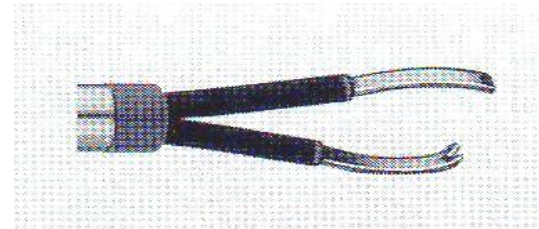
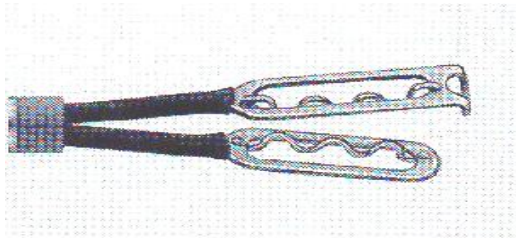
Or ordinary as other laparoscopic hand instruments,



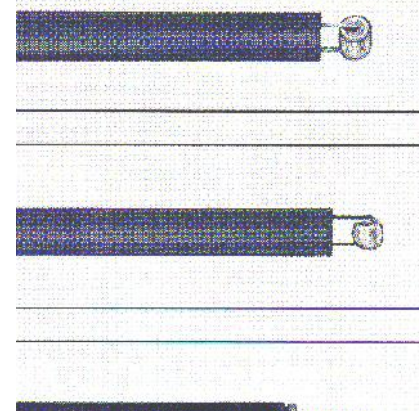
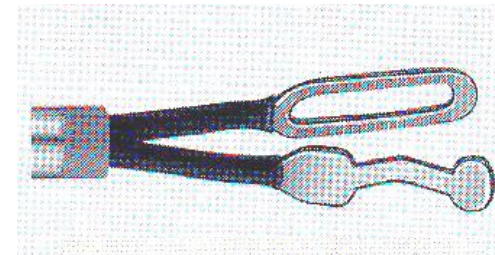
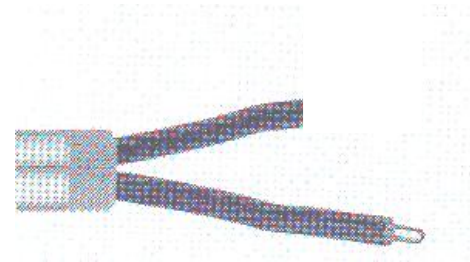
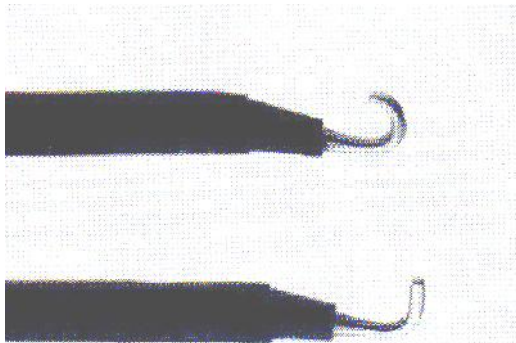
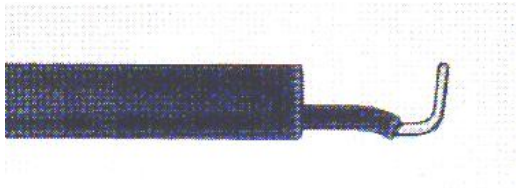


While the shaft in same in all types, but the tips are of different type and size



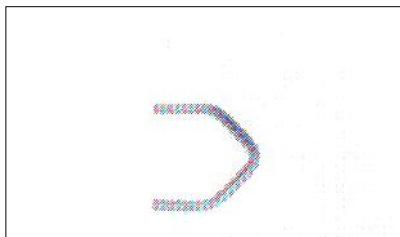


Some type hooked in the tip which used for dissection especially fine dissection of delicate structures or to pass under and coagulate delicate vessels



Clip and Clip Applier

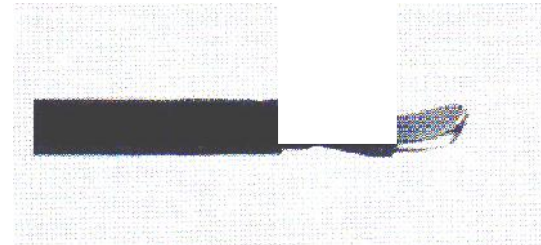
The application of small clip is adequate to completely occlude both artery and ducts like cystic duct. Two types of clip are available, one metal



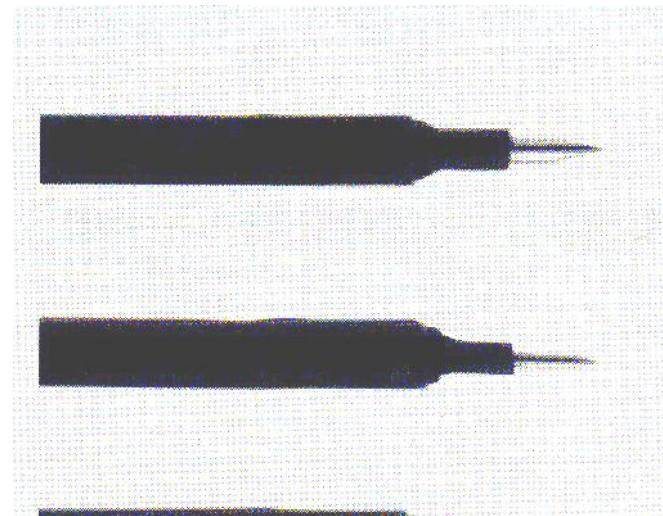
The other manufactured from polydioxanone(PDS), which are 6 or 9 mm in length.

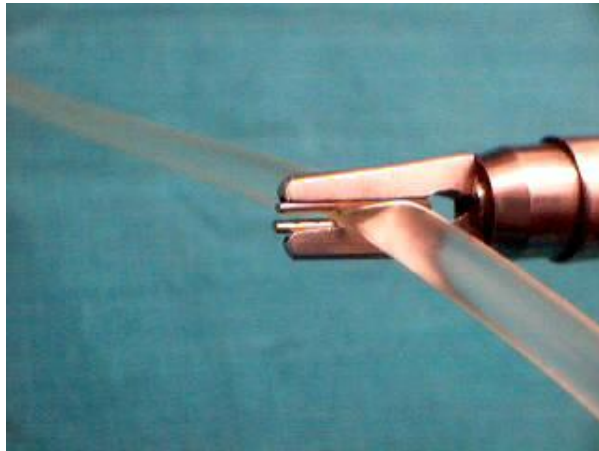


One type has a channel for irrigation which used for dissection and coagulation at same time



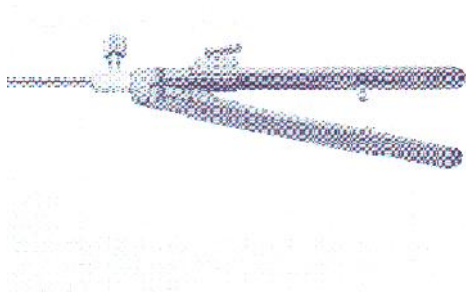
Some other has straight tip which used for puncturing cysts or tough capsules



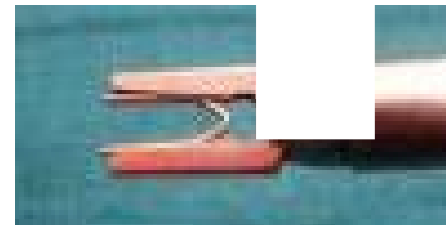


Needle holder

It composes of three parts handle is elongated with strong locking system and comfortable grip,



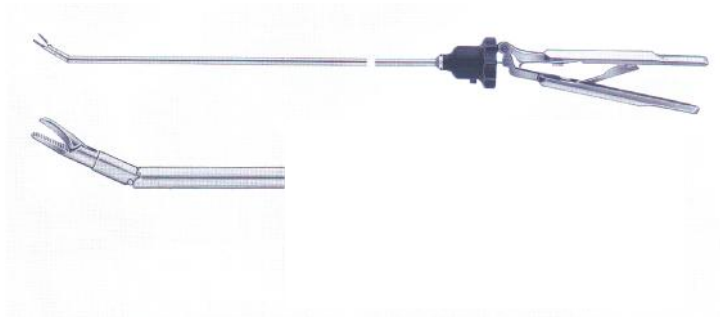
The metal clip appliers are 10mm instruments which introduce the clip into the abdomen in the open position,



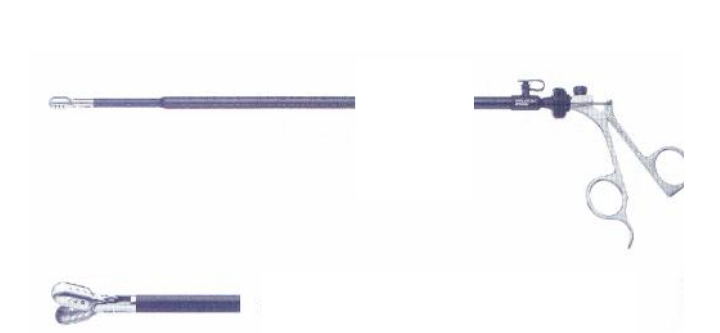
the jaws are placed around the vessel or the duct to be occluded and brought together by squeezing the instrument's handle, thus crushing the clip. They are either single reusable instruments which are reloaded after each application or disposable multiload appliers.

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New generation needle holders are angulated, could be rotated to any wanted angle

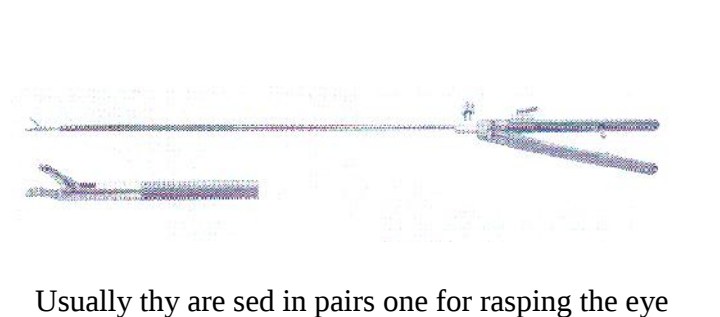


Another type of needle holder has integrated scissors which saves the time of changing the needle holder to scissors.



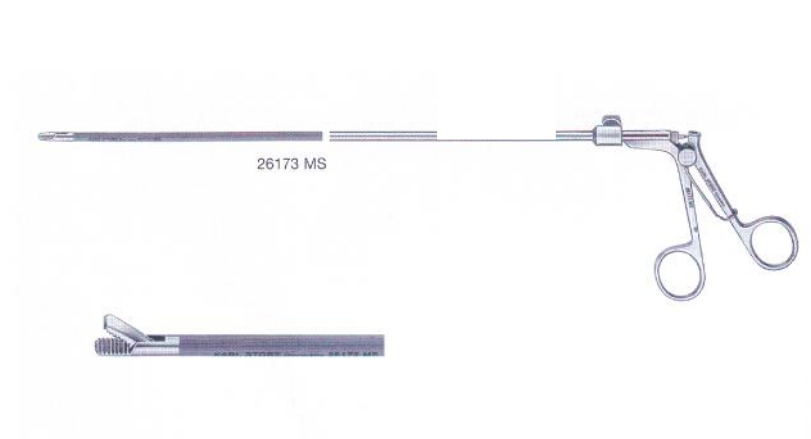
The needles are special and have different shape which is like a spoon

Shaft is same in all types while the tip is either curved or straight



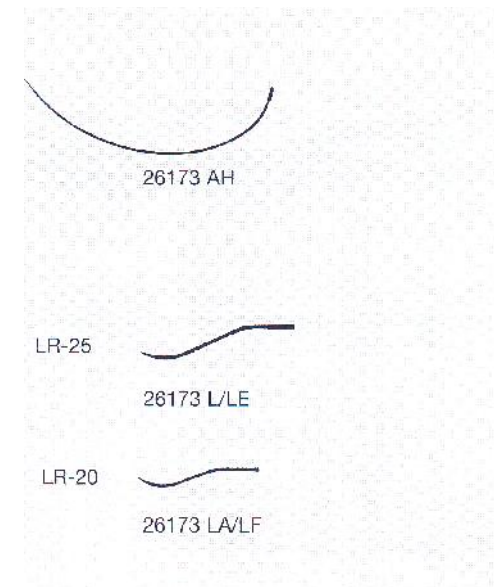
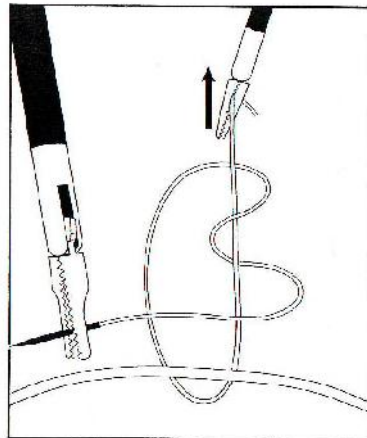
Usually they are used in pairs one for grasping the eye end of the special laparoscopic needle the other to grasp the tip of the needle after piercing the tissue

Some new needle holders also capable on grasping of the sutures

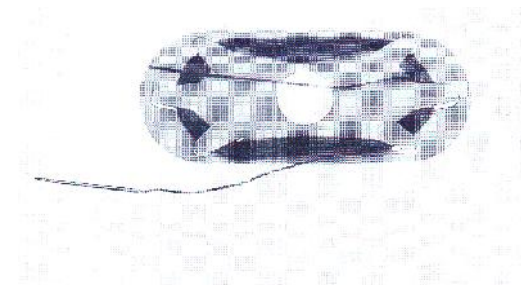


Knots

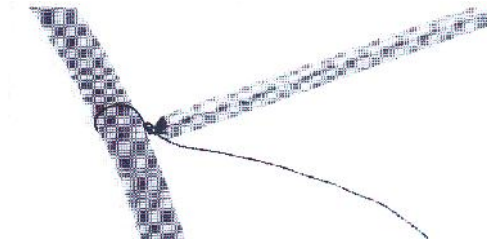
Different types of Knots may be used intraabdominally



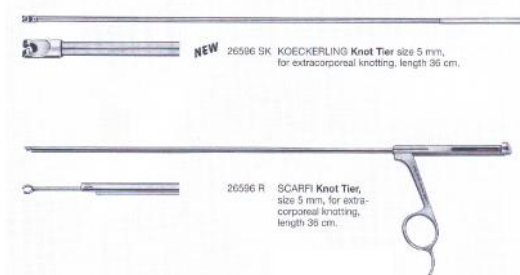
Either they are with thread or will be loaded with a thread after each use



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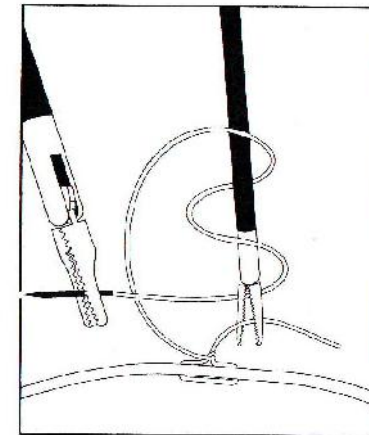
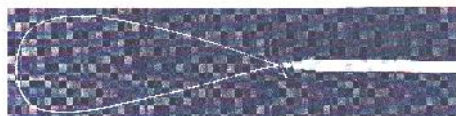
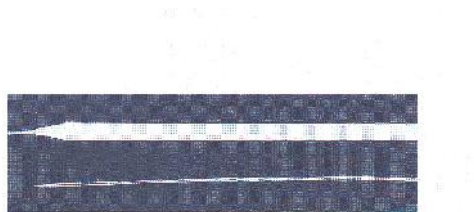


And we need knot tier for secure knots



Endoloop

Ready threads in the form of prepared knot used for ligation of a pedicle like appendicular stump



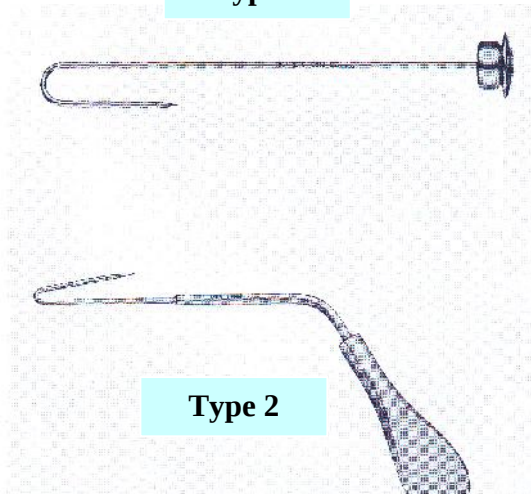
Knot holder

Ligatures inside the body cavity needs special instruments for holding them called knot holders

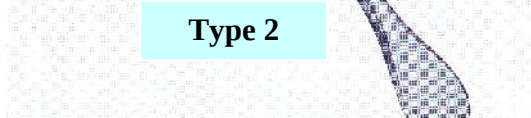


Also we need some instrument to push the knot to the desired point called knot pusher

Type 1

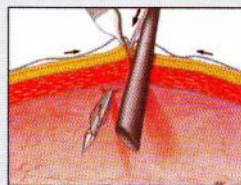


Type 2

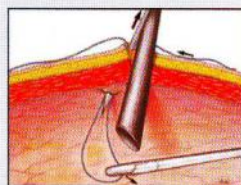


30140 KA Applicator for endo-ligature of bleeding vessels and for application of the 3 mm needle holder 26173 LS in trocar size 6 mm, color code: black.

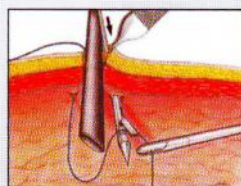
Fascia Suturing



106 Grasp the mid-length with forceps. Under direct vision, with adequate pneumoperitoneum, place the Fascial Closure Instrument into subcutaneous tissue directly into the trocar cannula. Incorporate all tissue layers as entry is made into the peritoneal cavity. Release suture.



Remove instrument. Leave adequate loop of suture in the peritoneal cavity and adequate extracorporeal tails.



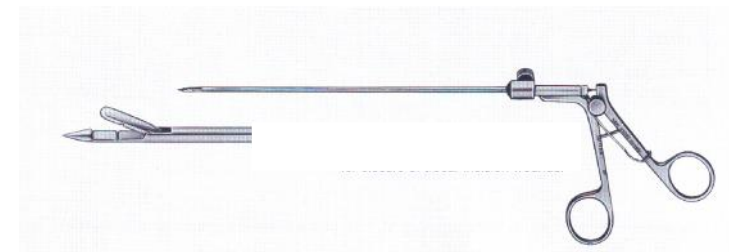
Again, under direct vision, reinsert Fascial Closure Instrument, without suture, on opposite side of trocar cannula. Place into the subcutaneous tissue incorporating all tissue layers. Grasp and retrieve the suture.



Remove instrument. The forceps will hold suture securely upon removal.

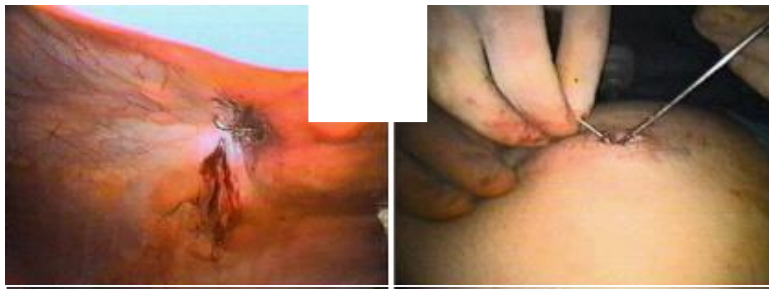
When 10mm trocar put or incision of 10mm trocar overstretched, there is possibility of hernia formation through the defect . So it is mandatory to suture the fascial defect.

We have two types o fascia suturing:

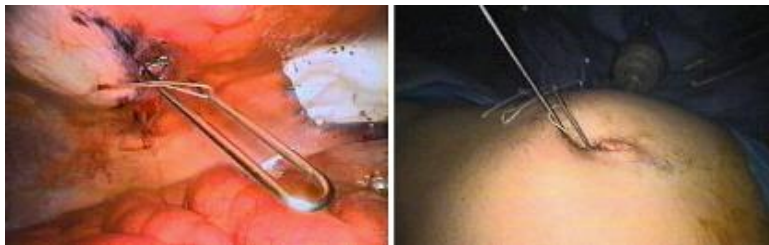


The trocar tube is removed and the J-needle is inserted through the incision under endoscopic guidance.

Gentle pressure is applied to the fascia as the needle is withdrawn, angling the needle so that it catches only the fascia and none of the subcutaneous tissue or skin

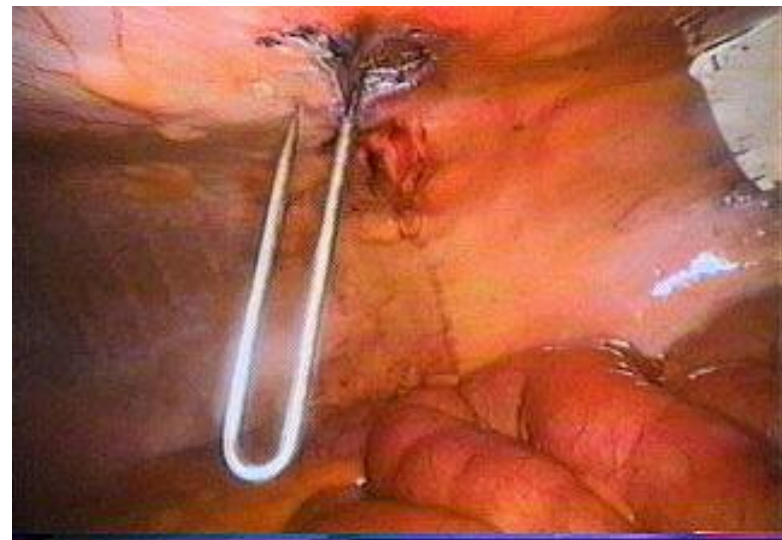


2.3: After withdrawing the needle, which has now engaged the fascia, the eye of the needle is threaded with a suture.



Fascial suturing with Type 1

The following pictures are showing suturing with Type 2



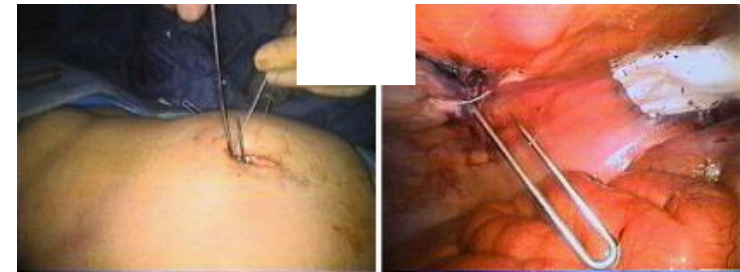
The only thing that now remains is to remove the J-needle. It is returned to the abdomen, and carefully positioned for removal, which can be the trickiest and sometimes most frustrating part of the procedure. By applying pressure to the back side of the "J," the needle can usually be freed from the incision

STAPLERS

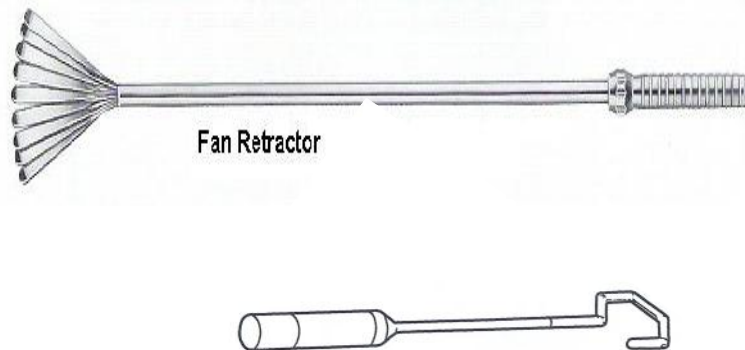
In some operation we need to close the ends or sides of bowel, may need 30 or more stitches, needs experience and long time.
. Medical technology solved this problem by emerging of new instrument called staplers which cut and suture the tissue on shooting of the instrument after insertion. The tip of the staplers must be loaded by staples after each use



The threaded J-needle is then pushed back into the abdomen and rotated 180 degrees. The surgeon momentarily looks at the video screen to verify safe positioning of the needle. The rotated needle is then delivered back out of the incision, catching the other side of the fascia.



RETRACTORES



LAPROSCOPIC CHOLANGIOGRAPHY

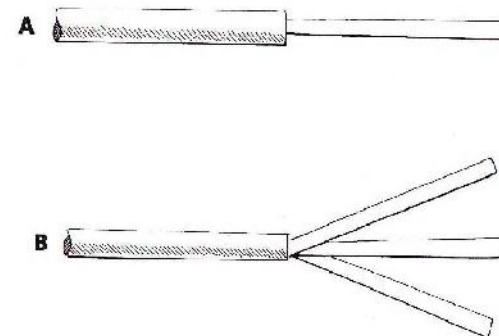
During some laparoscopic cholecystectomy, the surgeon needs to gain an idea about extrahepatic biliary tree. This done by what is called laparoscopic operative cholangiography.

The water soluble dye could be injected in to the common bile duct(CBD) by two ways ;

1. Direct injection of the dye into the CBD
2. Via cystic duct.



Blunt instruments to retract and restrain part of viscera in order to provide better access to the surgical site. Most of them have several fingerlike projections .could be inserted either via 5 or 10mm trocars



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cannula and second camera fitted to the eyepiece of the endoscope, helps in taking biopsy from inside the ducts

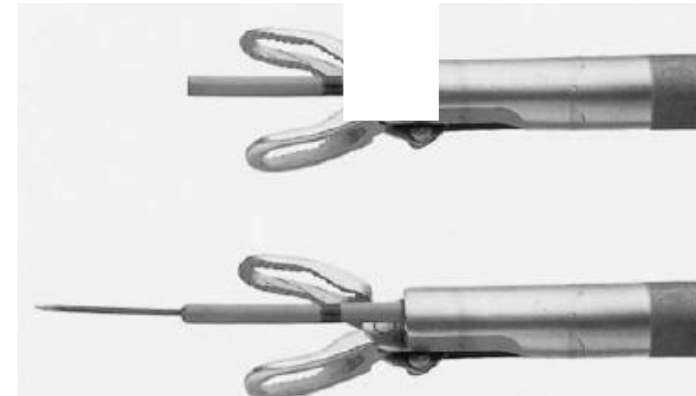
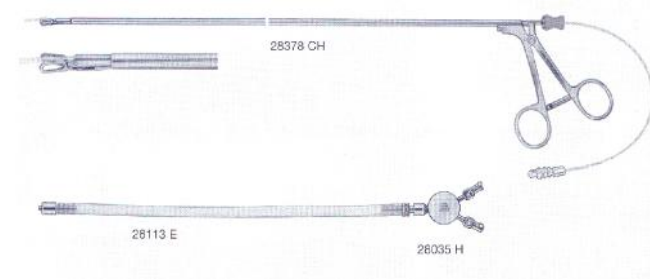


TRAINING EQUIPMENTS

Laparoscopy is an art to do great things through small openings



The preferable way is to use Oslon clamp with a size 6G Chevasseau catheters. the clamp consist of hollow lightweight aluminum cylinder approximately 30 cm long with a caliber which fits a 5mm port snugly. The distal end of the clamp consists of pair of opposing U-shaped jaw parallel to the long axis of the instrument which are controlled using a finely graduated ratchet mechanism the handle of the clamp



Some time the surgeon needs to look inside of the bile ducts by special flexible endoscope called cholangioscope, could be introduced via 5mm



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It has been shown that complication rates decreases sharply as more laparoscopic procedures are performed. Similarly the operation time is longer during the learning phase and decreases with experience.

Thus, it is of prime importance to ensure that a surgeon introduced to this particular operation is taught a correct technique. Few studies have focused on the actual learning process of a certain operation, although it is generally accepted that each procedure involves a specific learning curve, which is defined as the period before which acceptable quality is reached. For all surgical procedures, a surgeon's learning curve can be anticipated. It has been proposed that the first 50 laparoscopic surgeries performed in a center

Surgical competence entails a combination of knowledge, technical skills, decision making, communication skills, and leadership skills. Technical skill consists of dexterity and judgment based on knowledge. Laparoscopic surgery requires specific skills in hand-eye co-ordination and due to the lack of manual contact with the tissue and the restricted instrument mobility, the need for specific training is obvious.





and the first 20 performed by an individual surgeon present the highest risk for complications.

In the developed world training equipments became apart of any laparoscopic center.

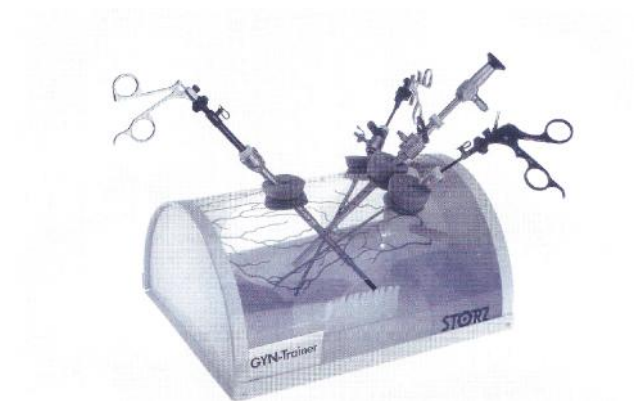
The idea is to help beginners to pass the learning curve and period safely. This period considered to be the first 13 to 30 laparoscopy for any surgeons in which the morbidity may occur.

There are two types of laparoscopy trainers

Box trainers

Training involves the use of box trainers with either innate models or animal tissues; it lacks objective assessment of skill acquisition.

It is simple as shown in the following pictures, it is a container resembling the abdomen, and you could put any animal viscera in it. Through ready ports you could introduce the instruments and do the procedures



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clear that practice on simulators improves performance on that simulator



Programmed Simulator machine



Simulator- based training

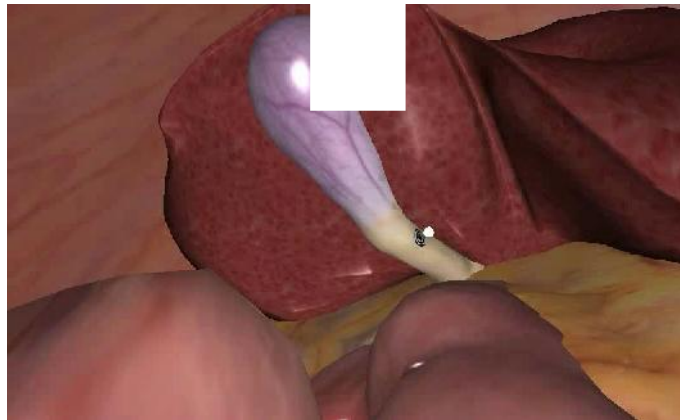
Second training equipment is sophisticated digital computerized system called laparoscopic simulator, which programmed in a way contains different operations,. When you train on it, the program will give you feedback and scores your job.

Simulator defined as “a task environment with sufficient realism to serve a desired purpose “ Undergoing structured training of basic skills training on the Minimally Invasive Surgical Trainer simulator (Mentice AB, Gothenburg, Sweden) followed by knot tying training on the LapSim simulator (Surgical Science, Gothenburg, Sweden).

The advanced Dundee endoscopic psychomotor

trainer (ADEPT) was originally designed as a tool for the selection of trainees for endoscopic surgery, based on the ability of psychomotor tests to predict innate ability to perform relevant tasks. Surgical simulators are convenient, flexible, and easier to standardize than their real-life counterparts.

Simulators claiming to be effective in the acquisition and evaluation of laparoscopic skill are not lacking. For minimally invasive surgery, they range from mirrored boxes to costly virtual reality interfaces, It is



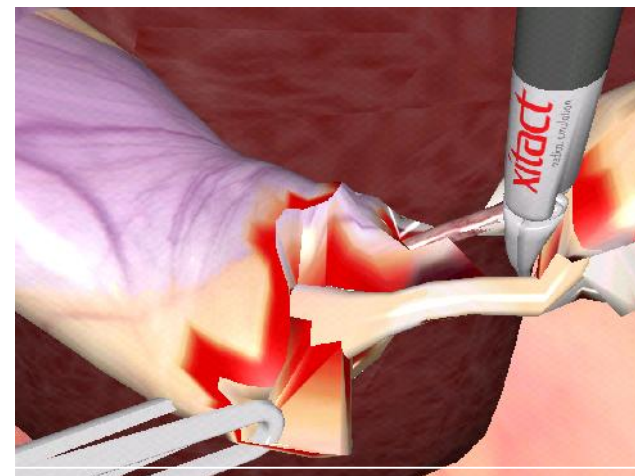
Simulating Gall bladder and liver



Simulating cystic duct and artery clipping with scoring

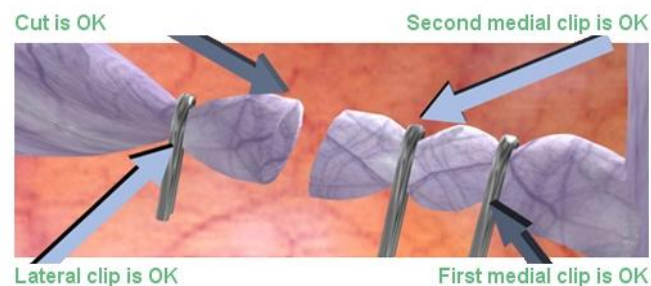
Virtual reality:

Virtual reality is defined as a collection of technologies that allow people to interact efficiently with three dimensional computerized databases in real time by using their natural senses and skills. Surgical virtual reality systems allow interaction to occur through an interface, such as a laparoscopic frame with modified laparoscopic instruments. The minimally invasive surgical trainer-virtual reality (MIST-VR) system was one of the first virtual reality laparoscopic simulators developed as a task trainer.



Simulating hepato-duodenal ligament dissecting cystic duct

Cystic duct Complete 50



Cystic artery Complete 50



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